INFN The construction technique of the new MEGII tracker

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ABSTRACT

The MEGII positron tracker is a unique volume, high granularity, all stereo, low mass cylindrical drift chamber. It consists of 10 co-axial layers, at alternating sign stereo angles arranged in 12 identical azimuthal sectors. Each layer contains 192 approximately square drift cells. Due to this high wire density and to the stringent requirements on the spatial resolution, the use of the classical feed-through technique as wire anchoring system could not be implemented and therefore it was necessary to develop an automatic system (wiring robot) with a highly performing control and monitor systems to synchronize the different operations. We present the construction technique used for the new MEG II tracker.

DRIFT CHAMBER

This particular construction technique gets around the use of wire feed-through, allowing for closer wire spacing, i.e. for smaller cells, therefore, for finer chamber granularities and for larger field to sense wires ratios, i.e. for thinner and lighter field wires.

Small cells and large number of wires, however, require complex and cumbersome assembly procedures, which call for a novel approach to the wiring problem.

WIRING SYSTEM

- The wiring system has the task of distributing the wire along a helicoidal trajectory with high precision and with a constant predefined mechanical tension.
- The mechanical tension of the wire is set to a nominal value monitored by a high precision strain gauge, and corrected with a real-time feedback system on the electromagnetic brake.

To this purpose, a wiring robot has been designed and built:

- to wind continuously variable wire pitches and stereo angles configurations;
- to apply a pre-defined mechanical tension to the wires and to maintain it constant and uniform (±0.05g) through the whole wiring;
- to monitor the wires location and their alignments within a few tens of μm ;
- to monitor the solder quality of the wire to the supporting Printed Circuit Boards;





mean wire tension is stable at the level of 0.05g



SOLDERING SYSTEM

- The soldering phase is accomplished by an LASCON Hybrid IR laser.
- The laser system is controlled by the NI CompactRIO.
- The wires, during the soldering phase, are protected with a Mylar

The wiring robot consists of:

- WIRING SYSTEM: a semiautomatic wiring machine with a high precision on wire mechanical tensioning (<0.05 g) and on wire positioning (<20 µm) for a simultaneous wiring of multi-wire frames;
- SOLDERING SYSTEM: a contact-less infrared laser soldering tool for anchoring the wires to the supporting PCB;
- **EXTRACTION SYSTEM:** an automatic handling system for removing the multi- wire frames from the wiring system and for storing them under continuously adjustable wire tension.

The wires are soldered on ad hoc wire PCBs fixed at the right distance, the use of wire PCB allows for higher densities of wires.

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EXTRACTION SYSTEM

The wound layer of soldered wires must be unrolled from the winding drum and de-tensioned for storage and transport to the assembly

station at INFN Pisa.



